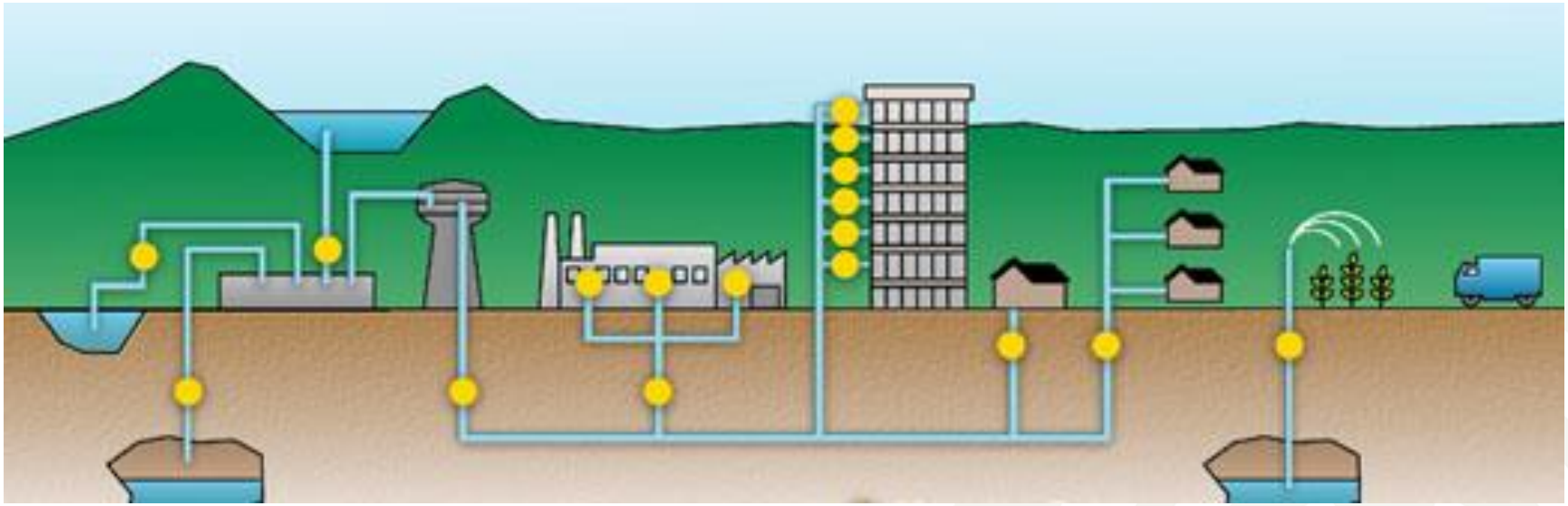
NEPTUNE
TECHNOLOGY GROUP INC.

Neptune Equipment
www.neptuneequipment.com

Commercial & Industrial Large Water Meters

ARB® Utility Management Systems™

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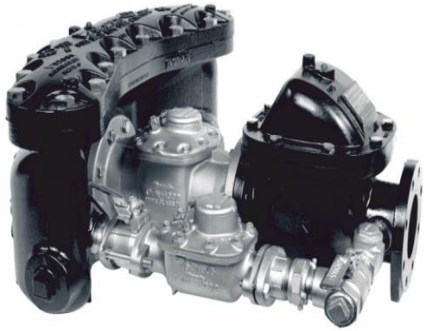

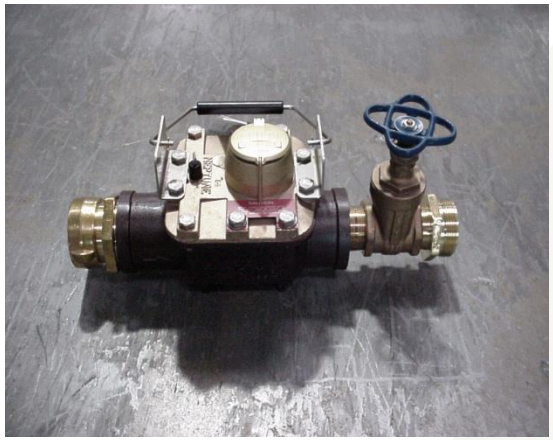


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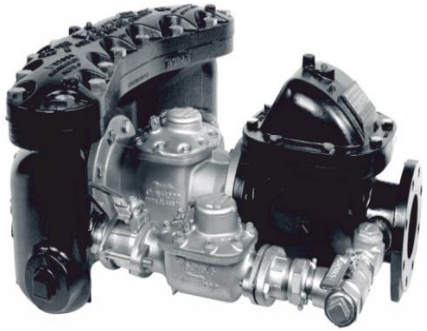
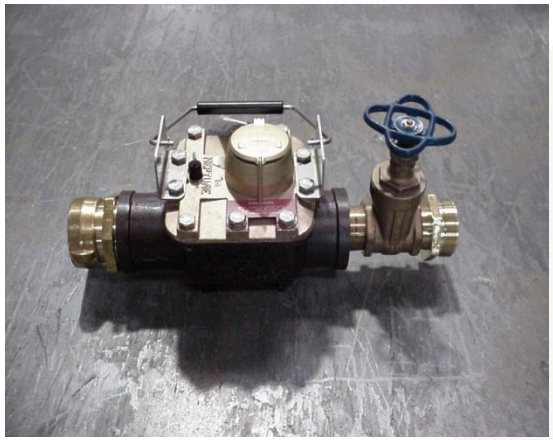


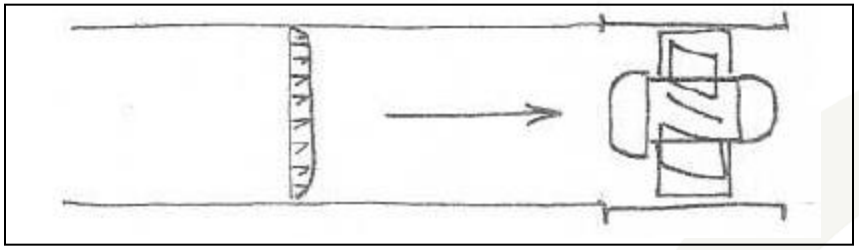


Specifications

- Clean Water Applications
- Maximum Operating Temperature: 80 deg F
- Maximum Operating Pressure: 150/175 PSIG
- Accuracy to within AWWA Standards of +/- 1.5%
- Velocity Meters
- Accuracy Calibration Vanes
- Unitized Measuring Elements (UME)
- All Register Options are available

Correct vs. Irregular flows

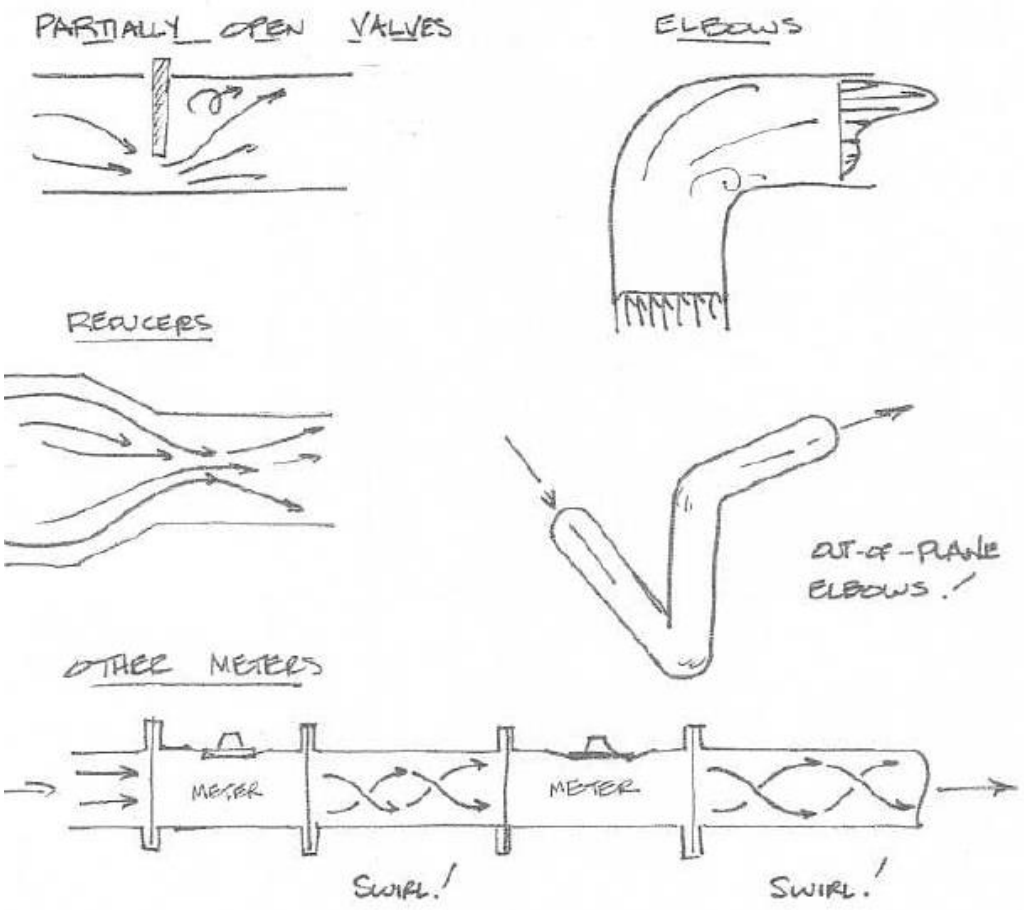
- For best performance, a turbine meter expects a uniform velocity profile.
- No swirl is allowed.



- Generally speaking, 8-10 diameters of straight pipe upstream will correct velocity profile, but not always.
- This extra length promotes mixing, and helps to eliminate flow irregularities.

Correct vs. Irregular flows

- **But what causes irregular flows?**

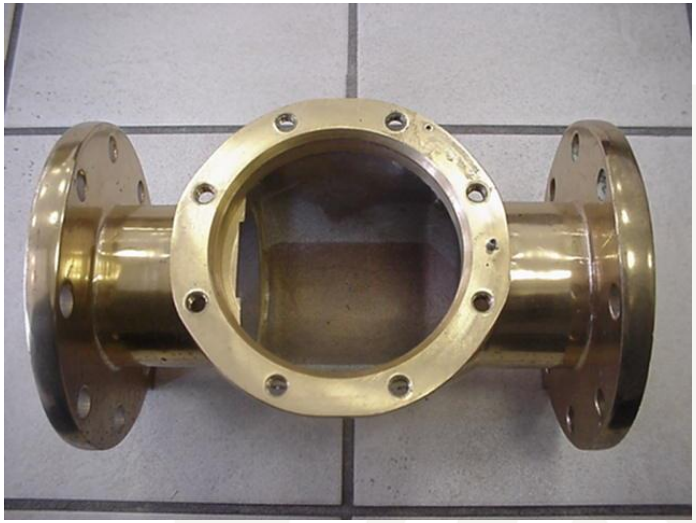


- **Generally, any abrupt change in the plumbing is a potential source of flow irregularities.**

Turbines

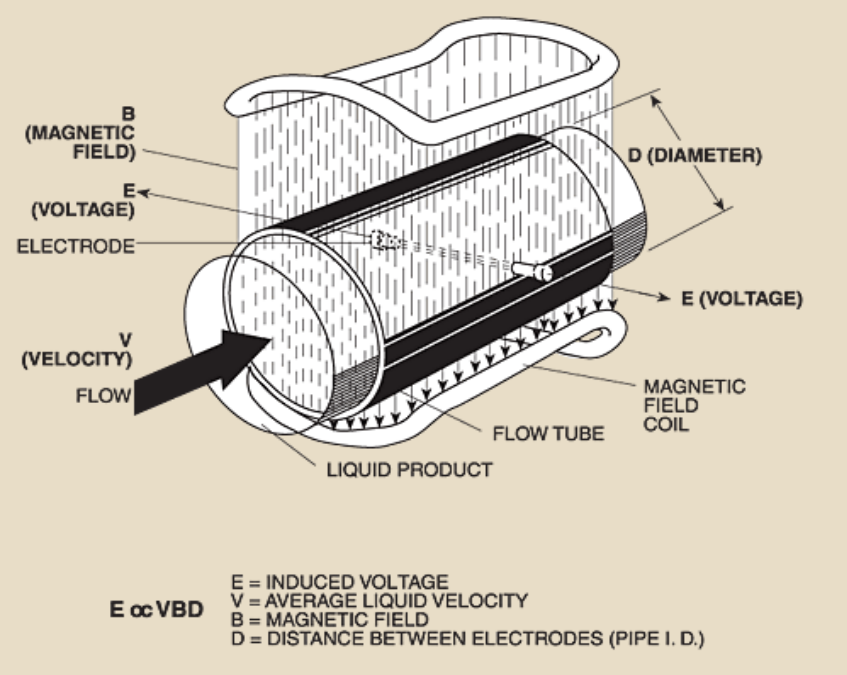
- Clean Water Applications
- Cold water Measurement
- Velocity Meter
- Velocity is proportional to the water flow rate
- Turbine rotor is used to measure the velocity
- Turbine rotor is magnetically coupled to the register

Turbine Meters - How Do They Work?



In-Line Magmeters

- Faraday's Law:When a conductive fluid passes through a magnetic field, a voltage proportional to flow is induced

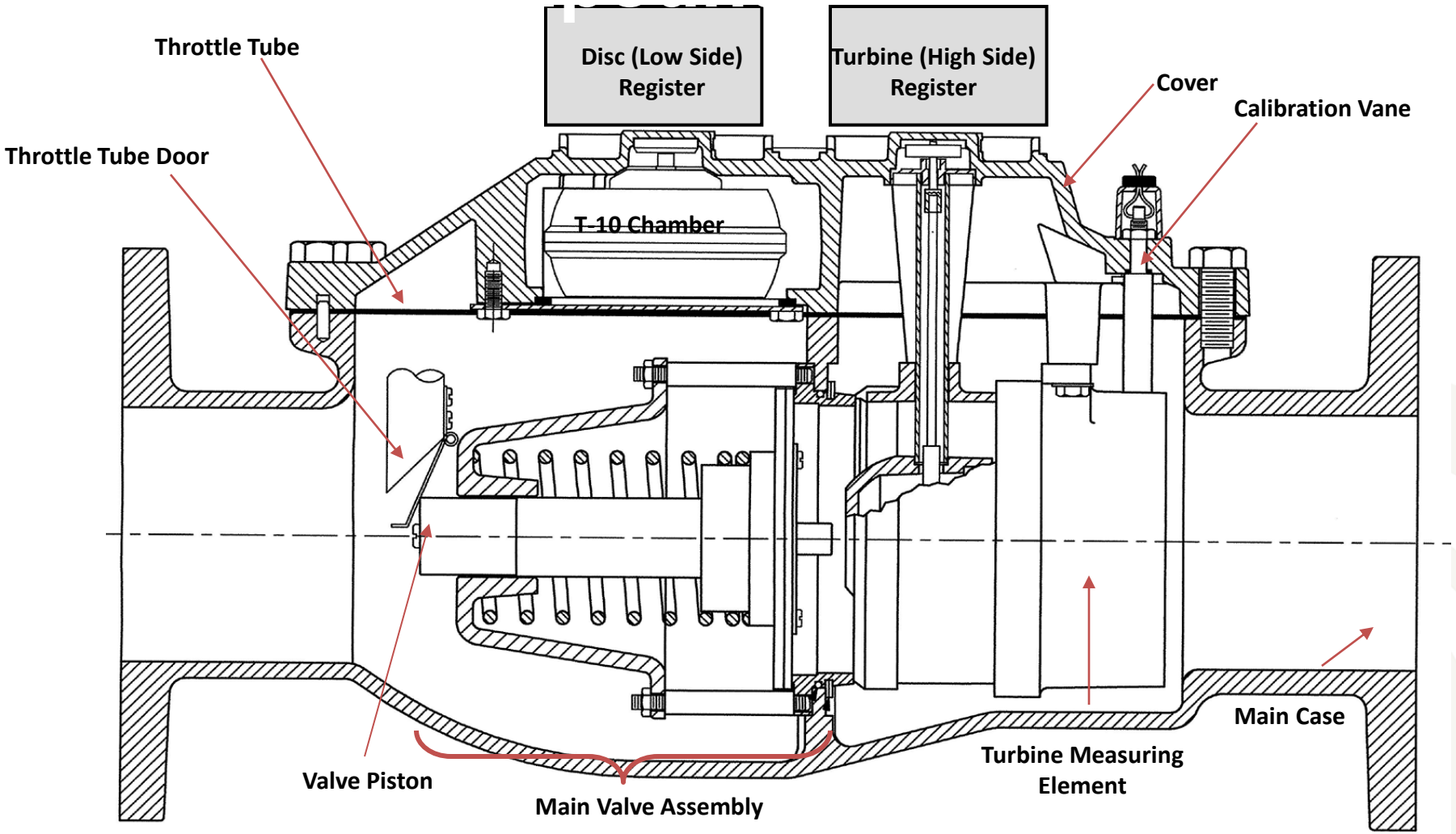


Compound Meters - How Do They Work?

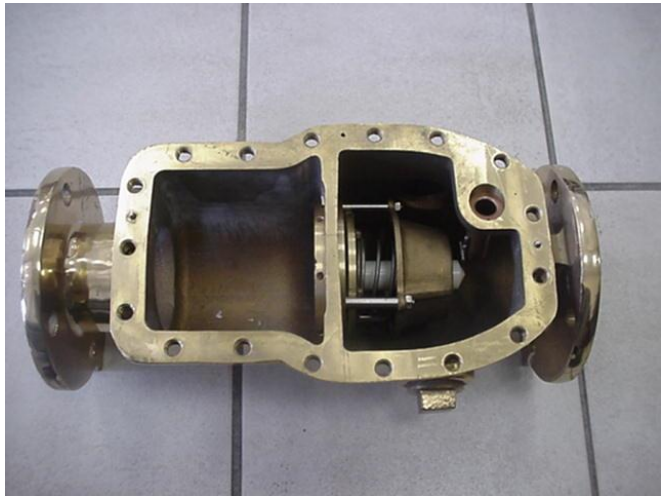
- Two meters in one maincase
  - PD meter for low flow rates
  - Turbine for moderate to high flows
- Hydraulic valve
  - to transition flows from PD meter to turbine and vice-versa
- Two registers
  - register for the PD meter and a register for the turbine meter
- Automatic Throttling Valve
  - to protect the PD meter from pre-mature wear
- Test Ports
  - facilitates testing

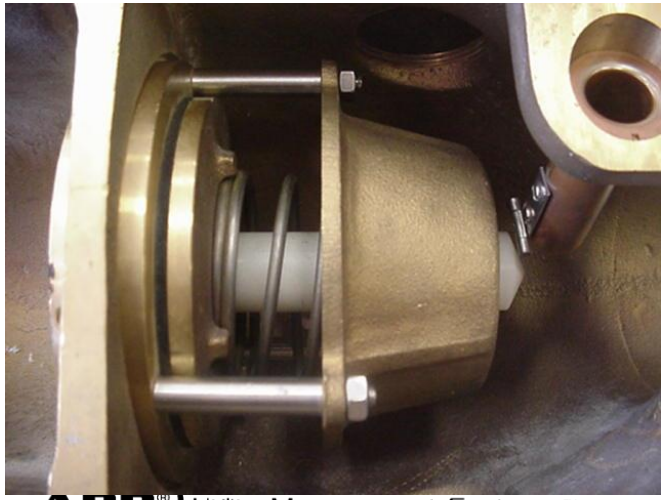
One Register vs. Two Registers

- **One Register Benefits**
  - Ease of reading
  - Billing System
- **Two Register Benefits**
  - Quickly identify problem with disc side
  - No coordinator to connect high & low side together
  - No oil required
  - Easier to calibrate
  - Facilitates a true UME design


Throttle Tube
Disc (Low Side) Register
Turbine (High Side) Register
Cover
Calibration Vane
Throttle Tube Door
T-10 Chamber
Valve Piston
Main Valve Assembly
Turbine Measuring Element
Main Case

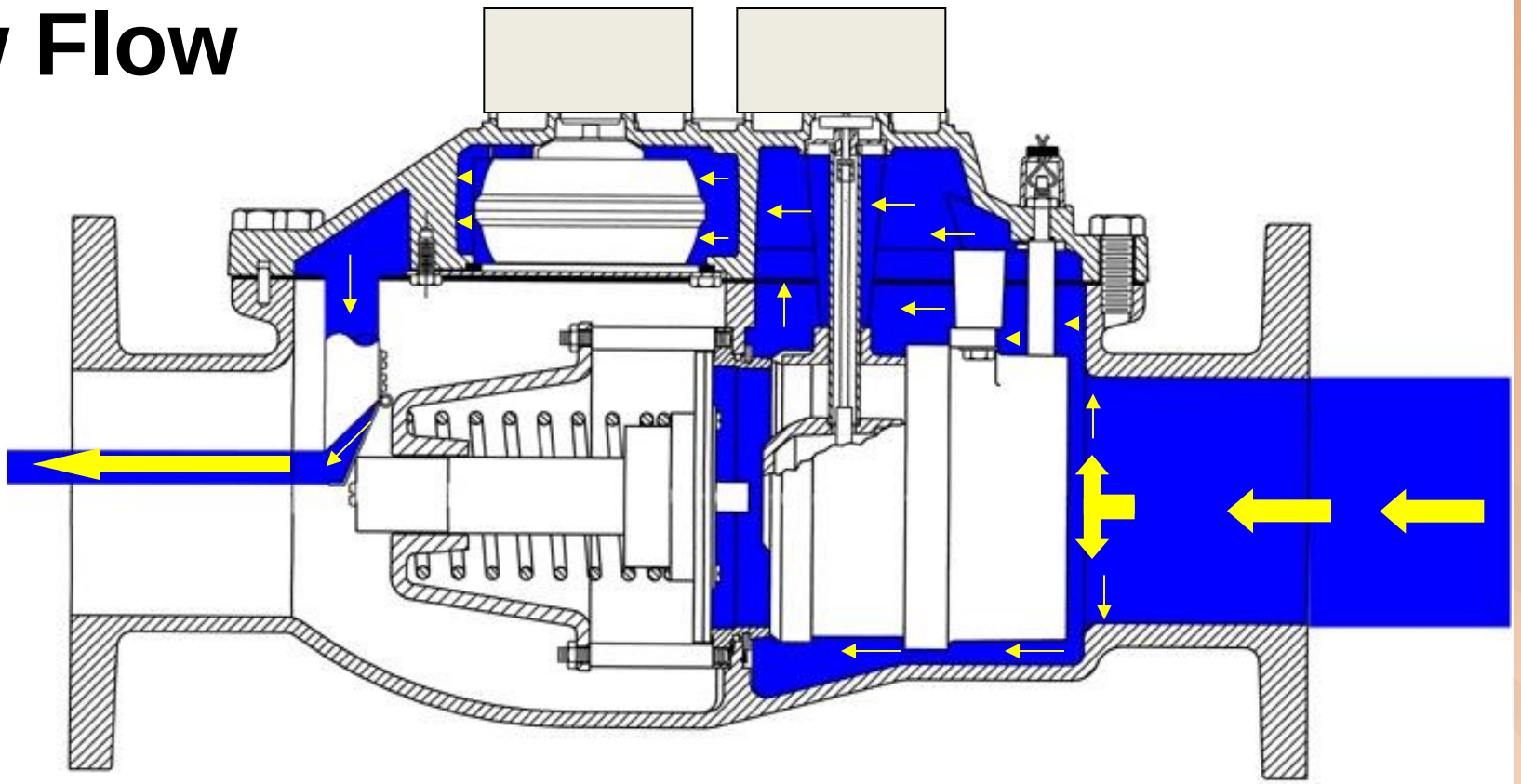
Compound Meters





- Cold Water Measurement
- No Lead Alloy
- NSF 61 certified
- 2” - 10” Sizes
- Flow Range: 1/8-2000 gpm
- Low to High Flow Rates
- High & Low Side Register
- Patented Hydraulic Valve
- Narrow Crossover Range
- Automatic Throttling Valve
- UME / Calibration Vane
- Test Ports

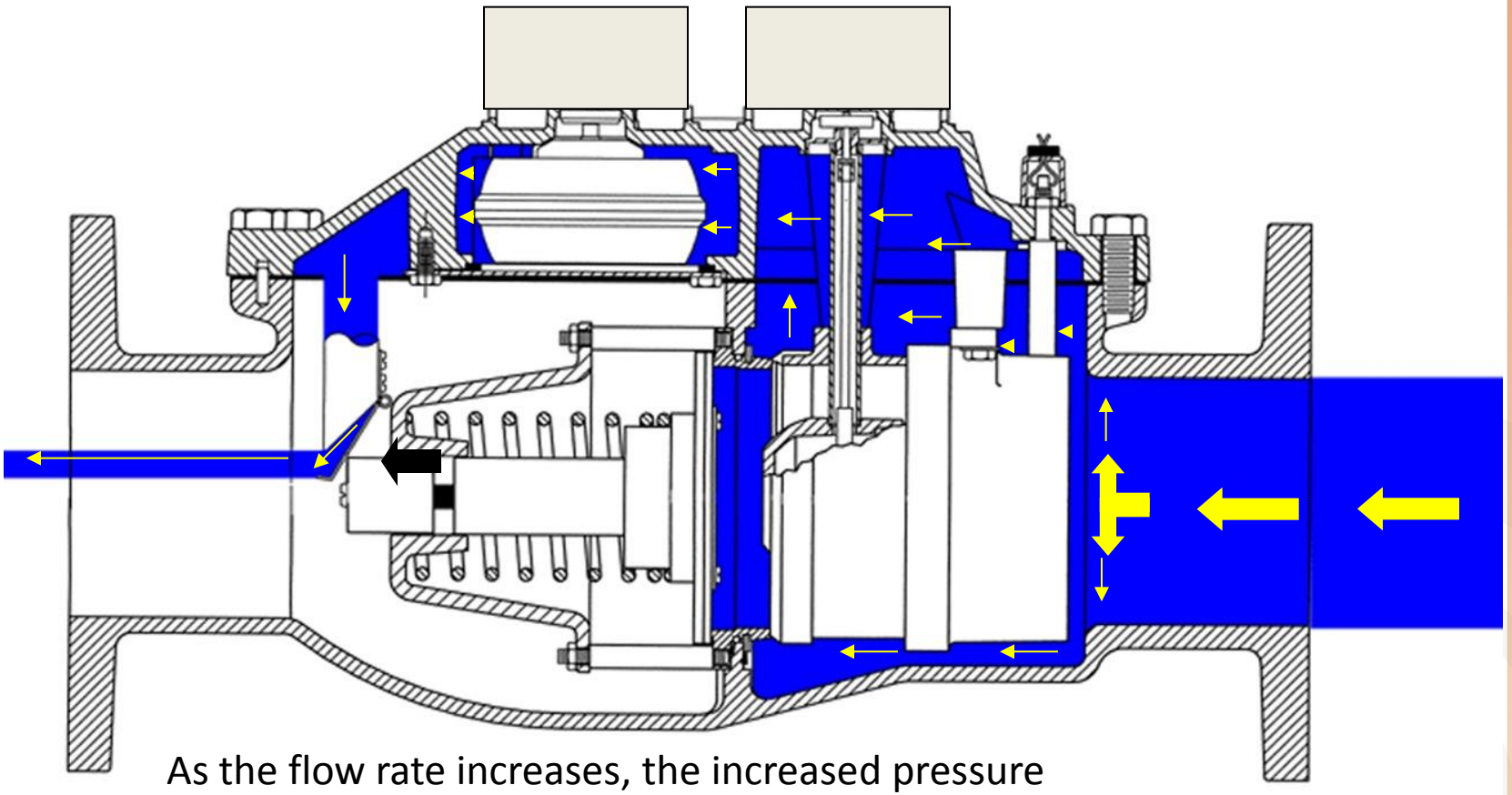
Low Flow



At low flow, the main valve prevents water from flowing through the Turbine element.

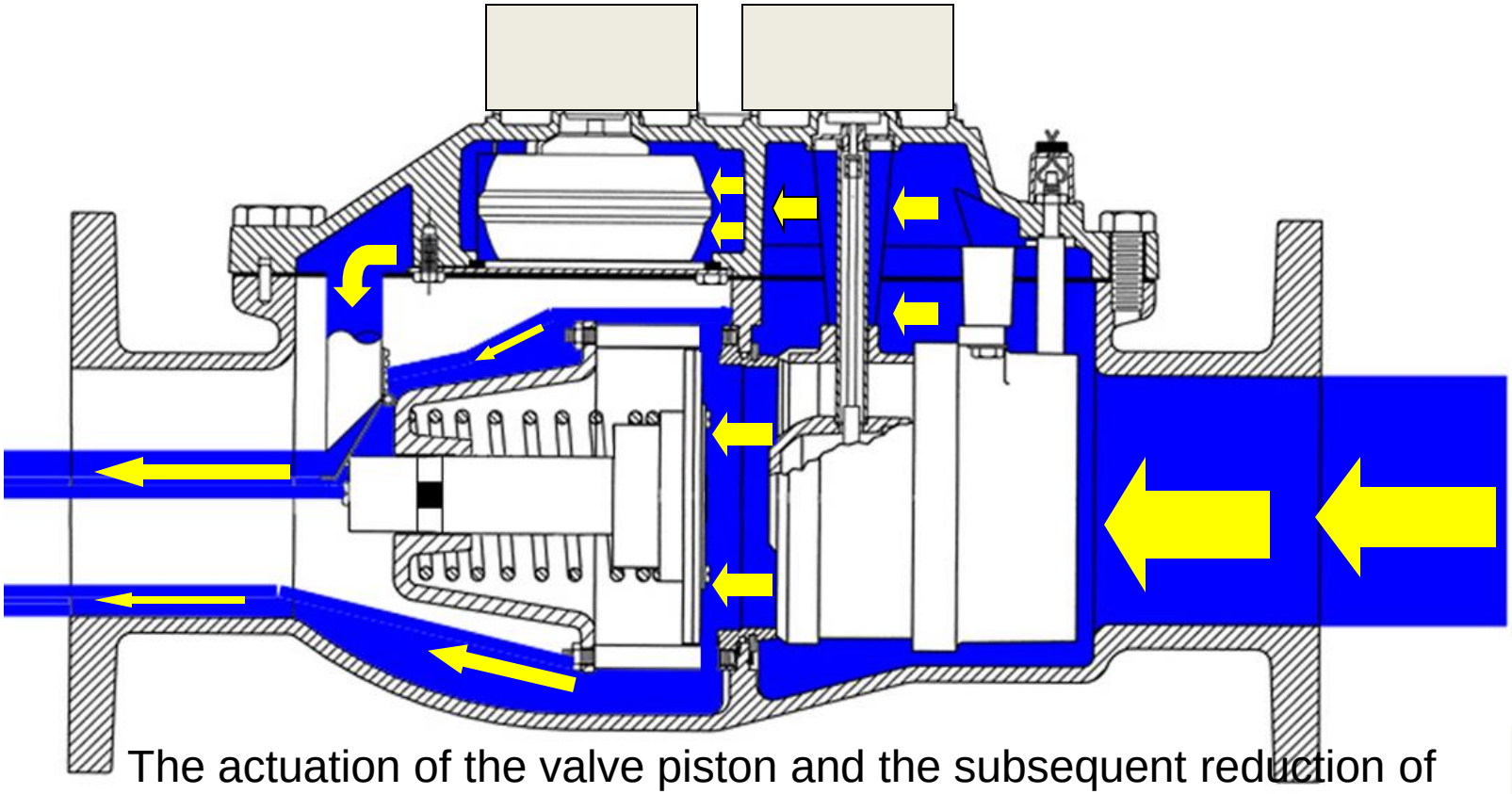
All water is diverted through the cover, into the T-10 chamber and out the throttle tube.

Crossover Imminent



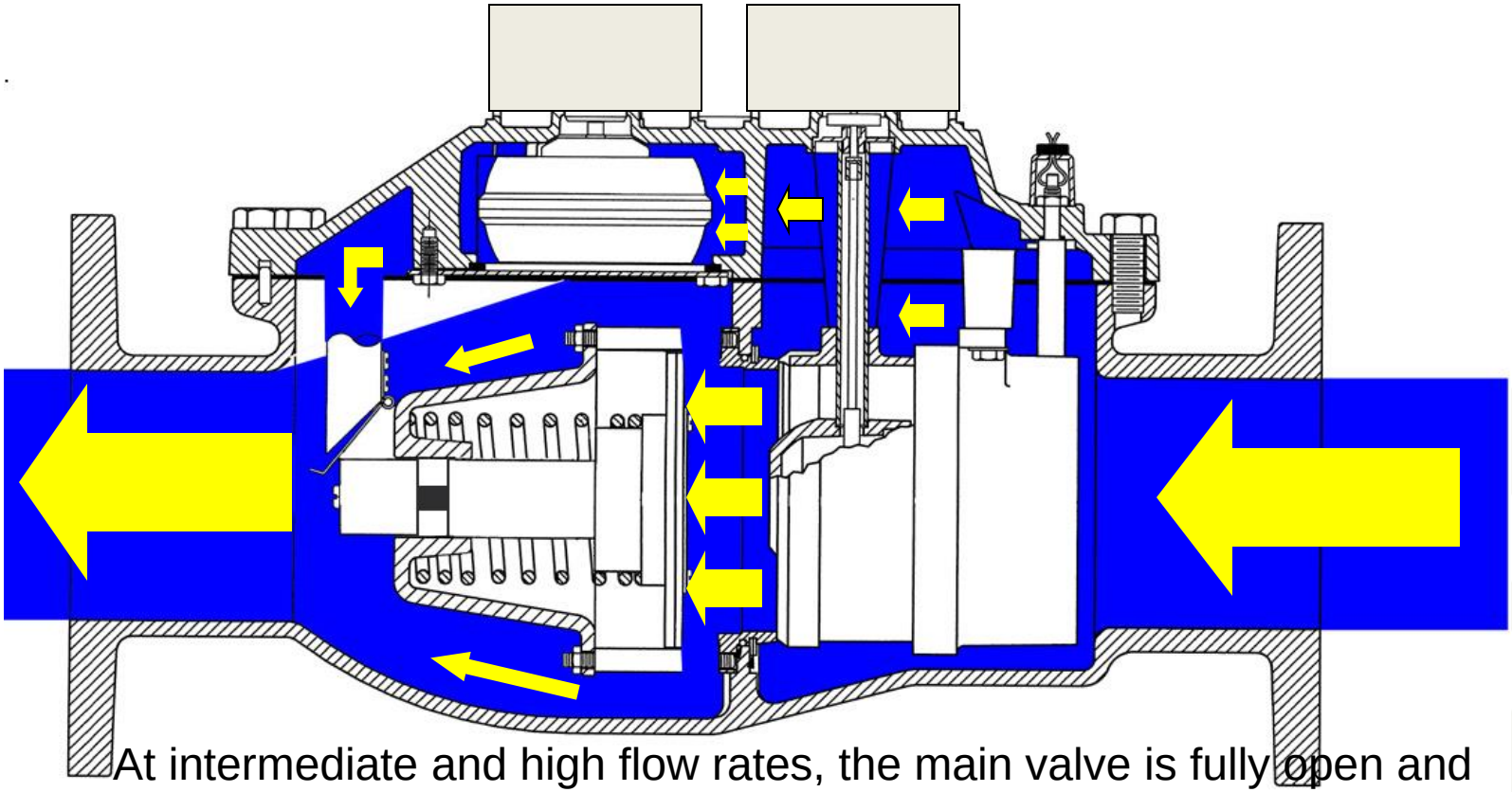
As the flow rate increases, the increased pressure differential causes the valve piston to move rearward, closing the throttle tube door, reducing the flow through the T-10 chamber.

Crossover



The actuation of the valve piston and the subsequent reduction of flow through the T-10 chamber “shunts” a large volume of water through the turbine measuring element forcing the main valve open. Both the turbine and the T-10 are operating.

Intermediate and High Flow



At intermediate and high flow rates, the main valve is fully open and the majority of the water flows through the turbine. Water continues to flow through the T-10 at a greatly reduced rate. This helps “flush” the the T-10 while simultaneously insuring that it does not “over-speed”

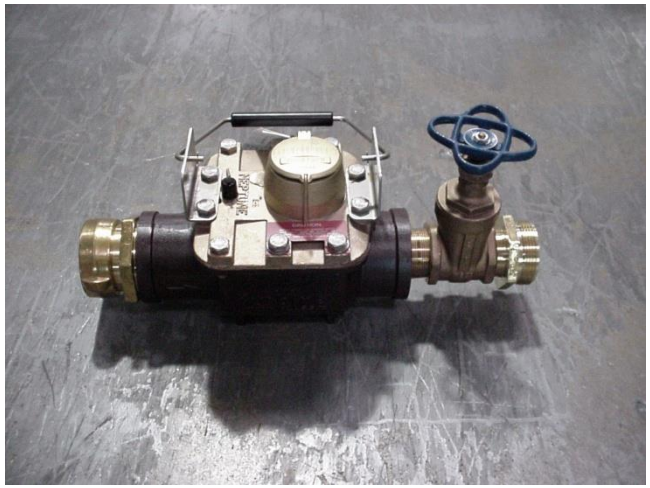
Fire Service Turbines

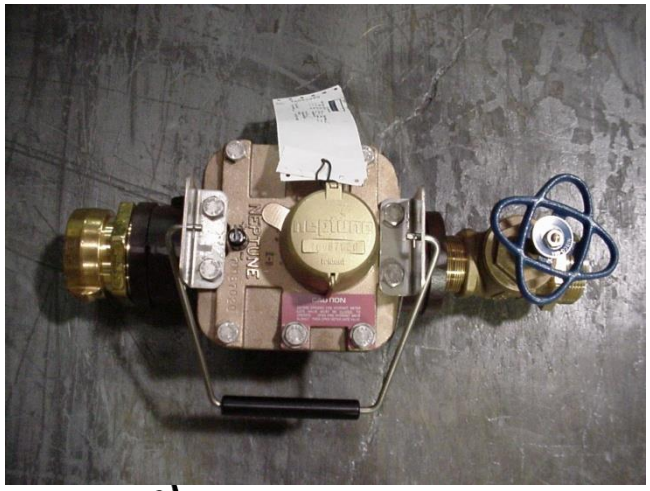
- Fire Service Applications
- Cold Water Measurement
- Moderate to High Flow Rates
- Uses Standard HP Turbine (NL)
- UL/FM Listed Basket Strainer
- Lightweight, easy to handle
- Corrects flow profile and
- Stops debris.

Fire Service Compounds

- Cold Water Measurement
- Fire Service Applications
- 4” - 10” sizes / 3/8 to 6500 gpm
- Low to High Flow Rates
- Main line Turbine (EB cover) with T-10 (NSF) or HPT (NL) on bypass
- Continuous operation
- Left or Right Side Bypass
- UL/FM Listed basket strainer
- Victaulic Coupling
- Spring Loaded SS Valve
- Automatic Throttle Valve
- Lightweight / Test Ports

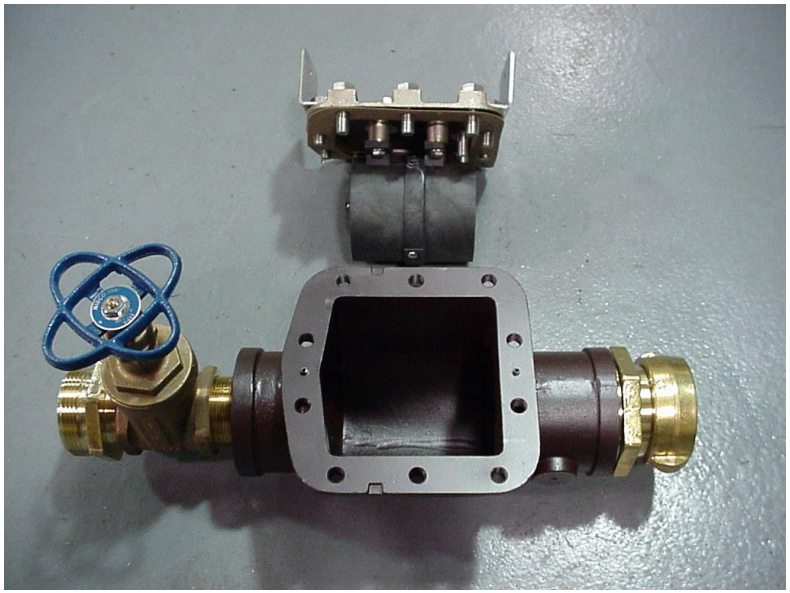
Fire Hydrant

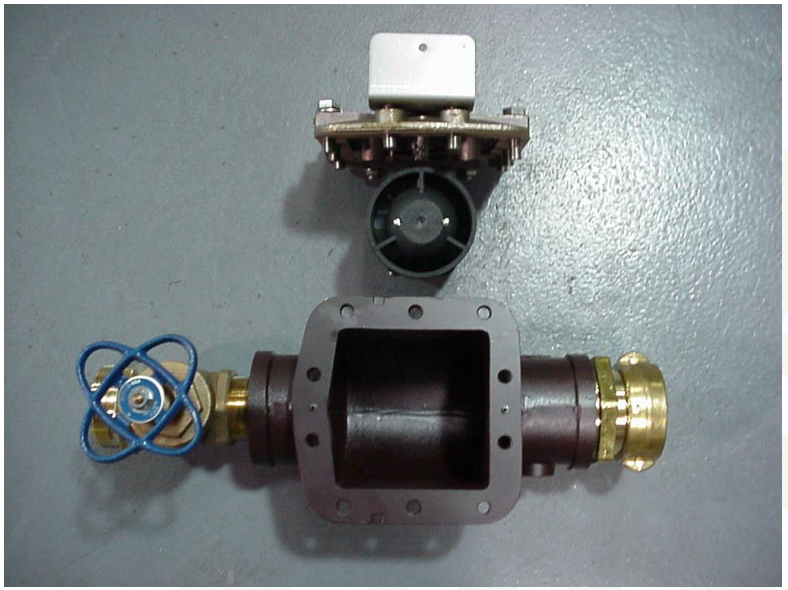




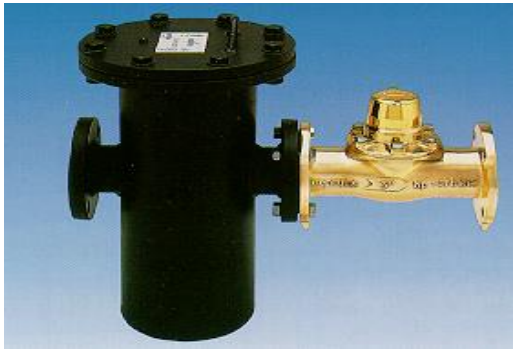
- Cold Water Measurement
- Fire Hydrant Applications
- 3” size
- 5 to 450 gpm
- 2” Gate Valve included
- Aluminum Construction
- No Lead Alloy Cover
- Internal Strainer
- UME - Factory Calibrated
- Accuracy Calibration Vane
- Lightweight, easy to handle

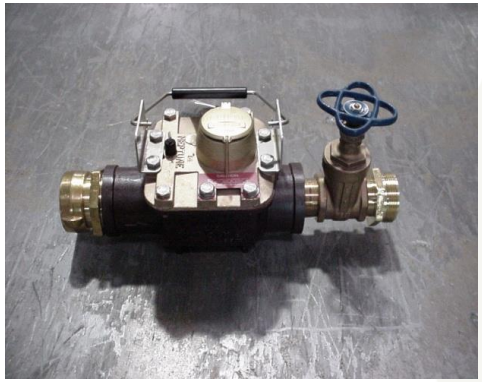
Fire Hydrant





Large Meter Sizing





Need for Correct Sizing

Historical "Rule of Thumb":

- Old sizing conventions - 3" meter for 3" pipe

Actual Realization:

- Flow capacity not always dictated by pipe size
- More and more customers use low flow devices - e.g. ULF Toilets = less consumption
- Often consultants recommend larger meter due to future growth which never occurs
- Buildings/facilities no longer used for original intentions - e.g. processing plant used converted to office space

Sizing Guide Background

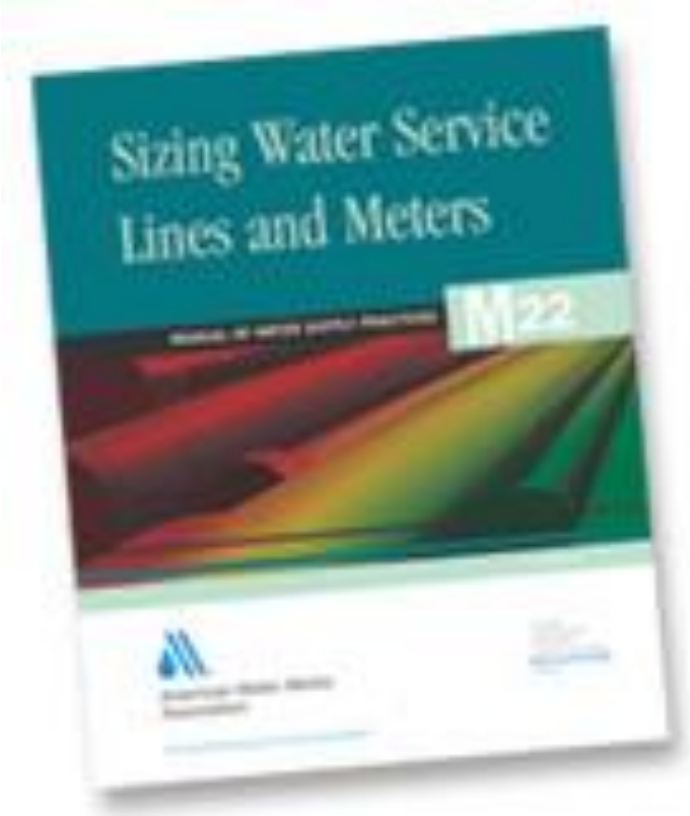
- Developed in the late 1980's
- Dedicated 1 person in utility to collect data full time
- Used data logger
- Collected 5 years worth of data
- Corrected sizing in many cases - e.g. 2" PD on 6" pipe
- Findings - correct sizing contributed in 2 major ways:
    - Increased annual revenue
    - Decreased annual capital expenditures

Sizing Meters

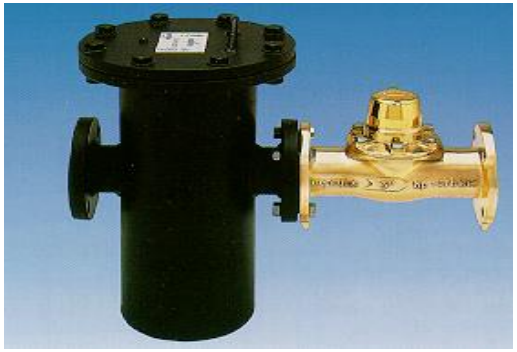
- **ALWAYS based on flow requirements**
- **Not based on pipe size**
- **AWWA M22 New Edition "Sizing Water Service Lines and Meters"**
- **Based on peak demand**
  - Pressures
  - Type customer
  - Fixture values
  - Continuous use demand
- **Requirements can change over time**

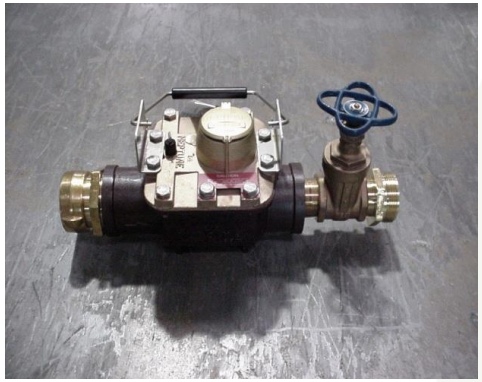
Sizing Water Service Lines and Meters (M22), Second Edition

This operations manual will guide engineers, architects, designers, and technicians in accurately sizing customer water service lines and water meters. Coverage includes estimating consumer water flows, peak water demands, demand profiling, metering equipment, and procedures for calculating service lines and meters for optimum water revenue and lowest service cost. Numerous tables and sample calculations included.



Large Meter Applications





Moderate To High Continuous Flow Rates

- **Processing Plants**
  - **Manufacturing Facilities**
  - **Irrigation Lines**
  - **Lawn Sprinkler Systems**
  - **Wells**
  - **Effluent Water in Treatment Plants**
  - **Booster (Pump) Stations**
  - **Large Batching Operations**
  - **Inter-system sales or transfer**
  - **Office Buildings**
  - **Public Transportation Centers**

  WHERE PEOPLE WORK!!

Low To High Continuous Flow Rates

- **Apartment Buildings**
  - **Motels and hotels**
  - **Condominiums**
  - **Mobile Home Parks**
  - **Hospitals and Schools**
  - **Restaurants**
  - **Dormitories**
  - **Department Stores**
  - **Shopping Malls**
  - **Public Transportation Centers**

  WHERE PEOPLE LIVE!!

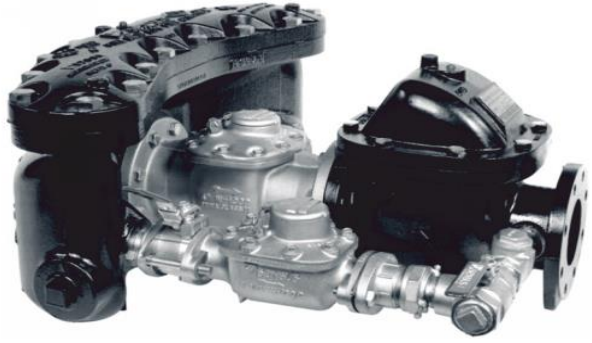
Fire Service Applications

Must be UL/FM Approved

Designated Fire Protection Lines

Any of the HP Turbine or TRU/FLO meter applications that utilize the same service line to provide fire protection

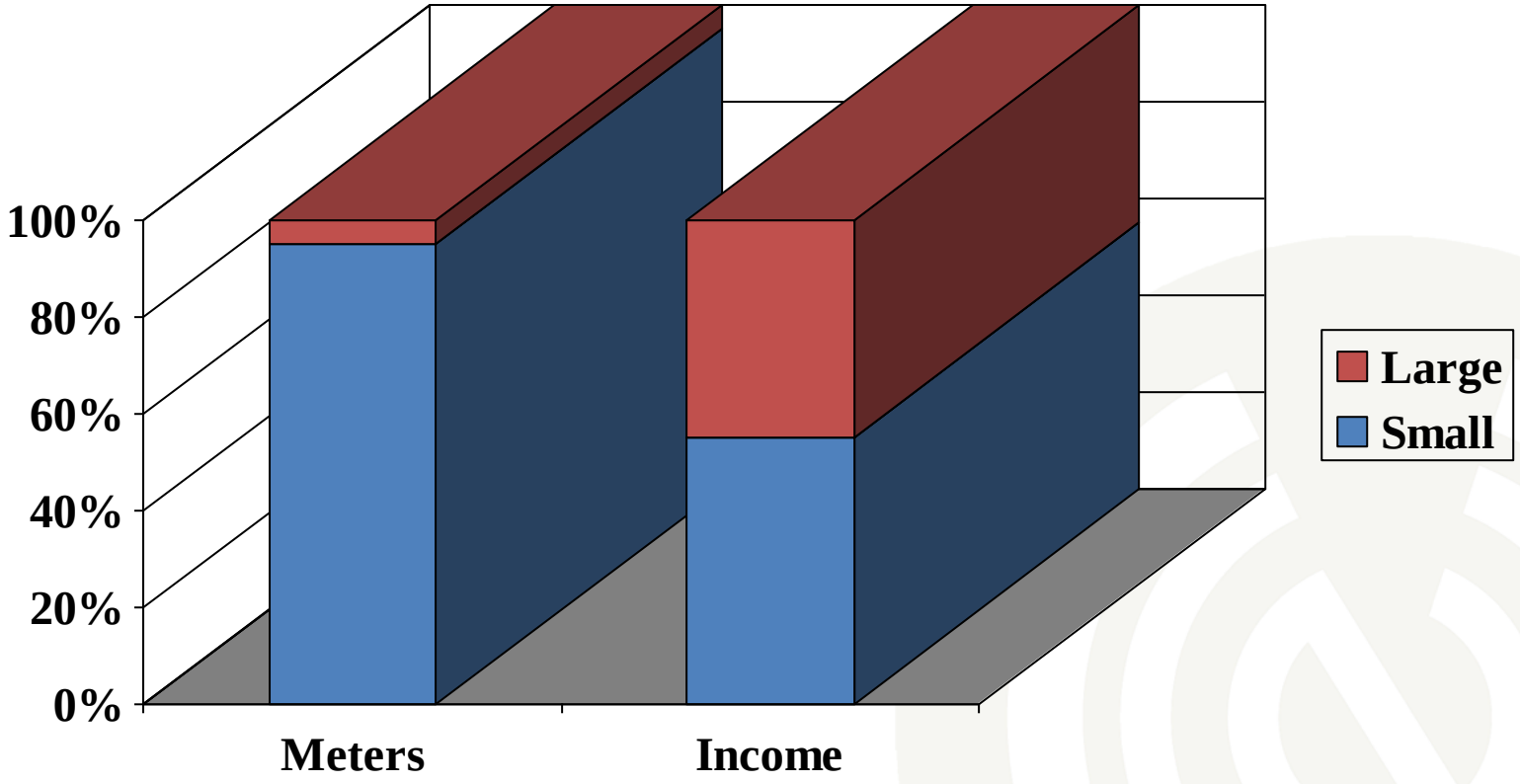
WHERE PEOPLE WORK AND LIVE!!



Large Meter Installation

- *Use of strainer strongly recommended!*
  - Corrects velocity profile
  - Protects turbine from debris
- *No strainer installed*
  - Risk turbine damage
  - Need 6-10 (Estimated Pipe
  - Diameters) E.P.D. upstream of meter
  - Test Tee at least 2 E.P.D. downstream of meter on turbines.

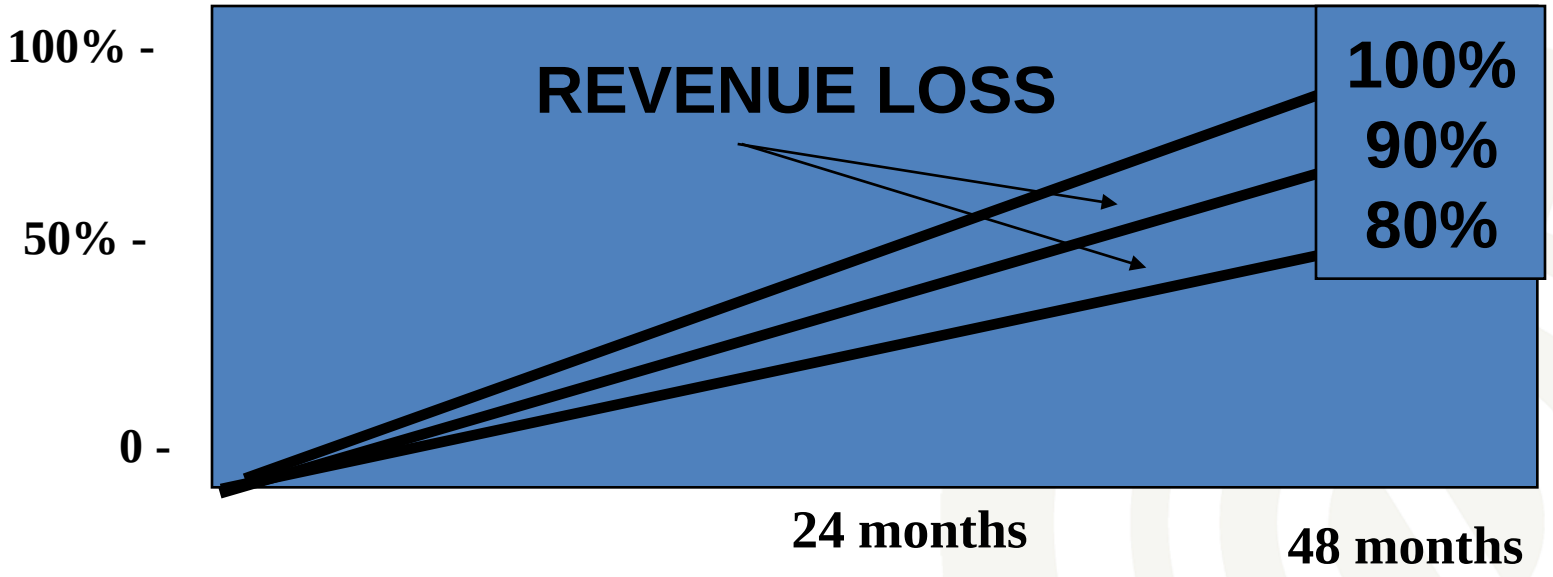
Meters vs. Revenue



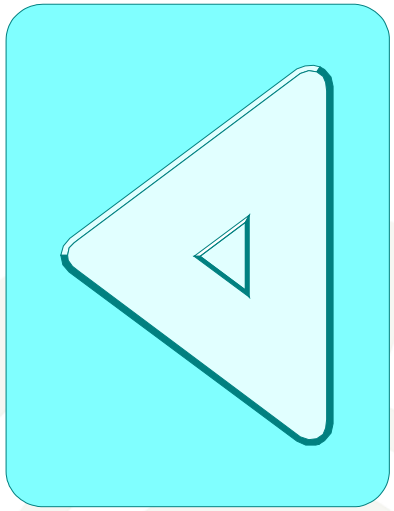
Is your utility getting all the revenue it's entitled to?

The Reality

In most water systems, the reality is that their large meters are operating at 80% to 90% accuracy.

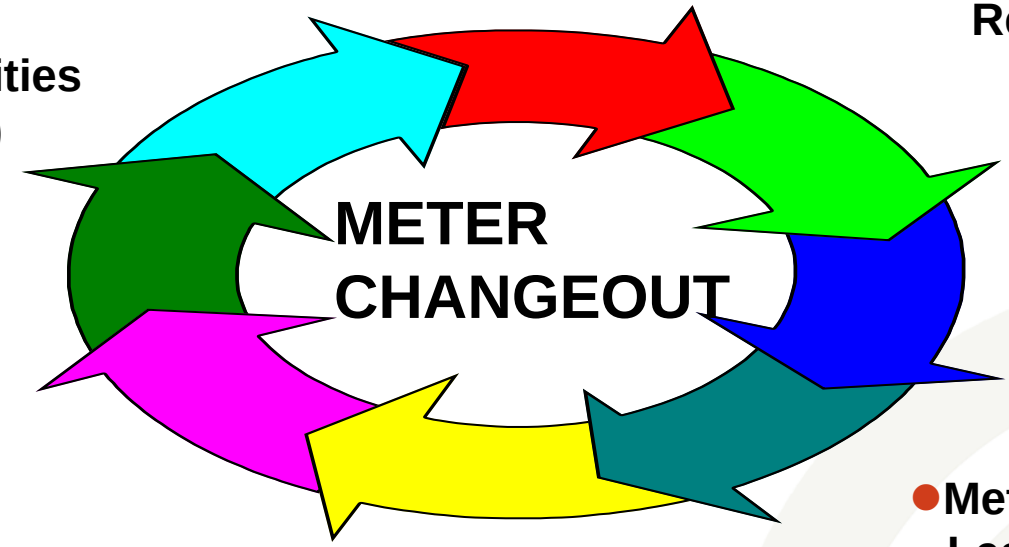


WHY SHOULD YOU BE CONCERNED ABOUT WATER AND REVENUE LOSSES?



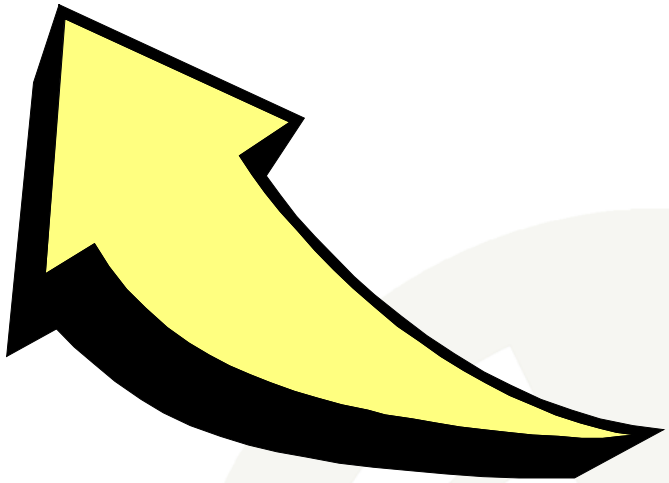
The Market Drivers

- Increased Operating Costs
- Decaying Facilities (Infrastructure)
- Rising Water Demands
- Increasing Problem Of Unaccounted For Water
- Commitment To Increasing Meter Reading Efficiencies
- Meter Replacement Less Expensive Than Repair
- Declining Government Funds
- Increased Focus On Revenue Recovery

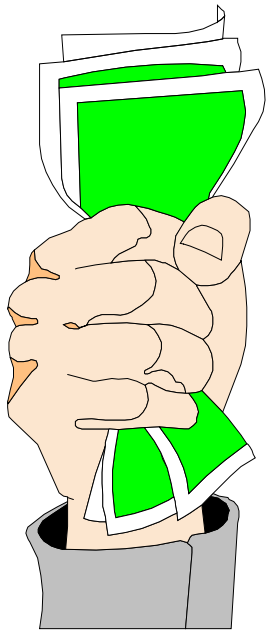


How Is This Revenue Lost?

- Meter Failures
- Meter Inaccuracies
- Misapplication
- Sizing
- Undetected Leaks
- Theft



Large Meter Revenue



- **Large meters = Large Revenue**
- **You can't afford to have them running inaccurately**

Solution

- Inaccuracies
  - Annual tests
  - Proper meter for the application
- Leaks and Low Flow loss
  - Profile meter flow rate
  - Proper meter sizing
- Failure
  - Specify strainers
- Theft and Un-metered
  - Fire service meters
  - Distribution meters

Maintenance Programs

Options

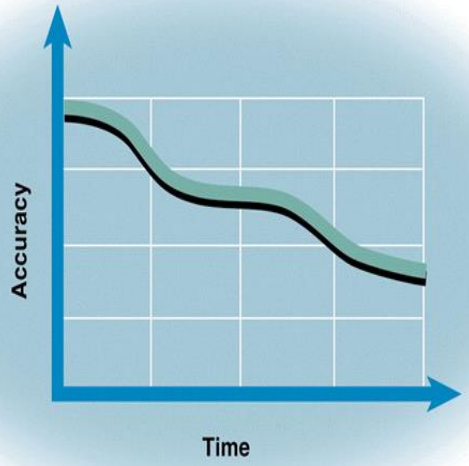
- UME Replacement Program
- Utility does all testing and repairs
- Replace entire meter
- Hire outside company

UME Replacement Program

Easily maximizes revenue at large meter sites

- **Cost Effective**
- **Meter repaired quickly – little down time for customer**
- **"New" UME's have new moving parts**
  - **No-Lead Alloy material**
  - **ANSI NSF 61**
  - **Tested to new meter standards of + / - 1.5%**
  - **Shipped with test tag**
- **Install the "New" UME and keep the old or defective UME for rebuilding.**
- **Available on HP Turbines, TRU/FLO Compounds, HP Fire Service, and HP Protectus III meters**

Water Meters Lose Accuracy Over Time



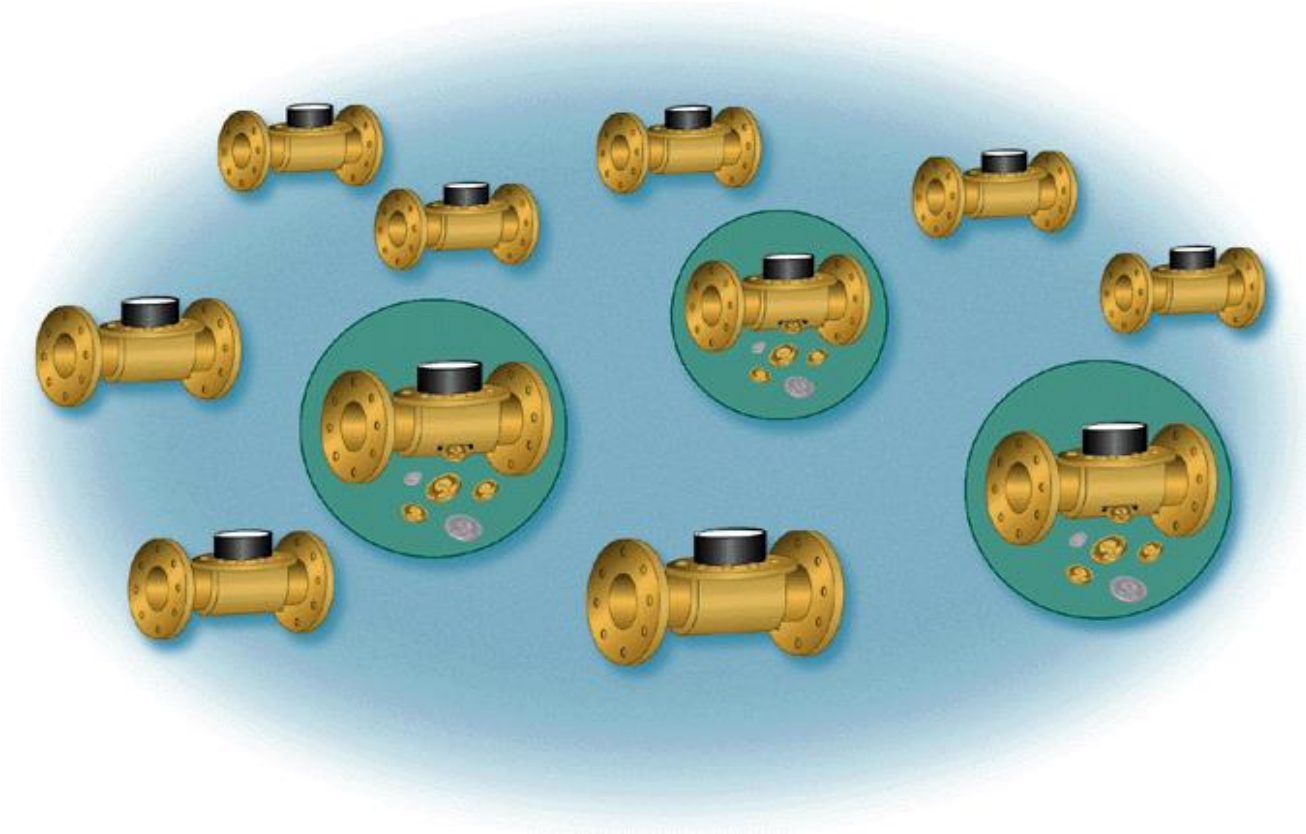
Results:

lost revenue for the utility

OR

higher rates to recover losses

But, which meters are losing money?

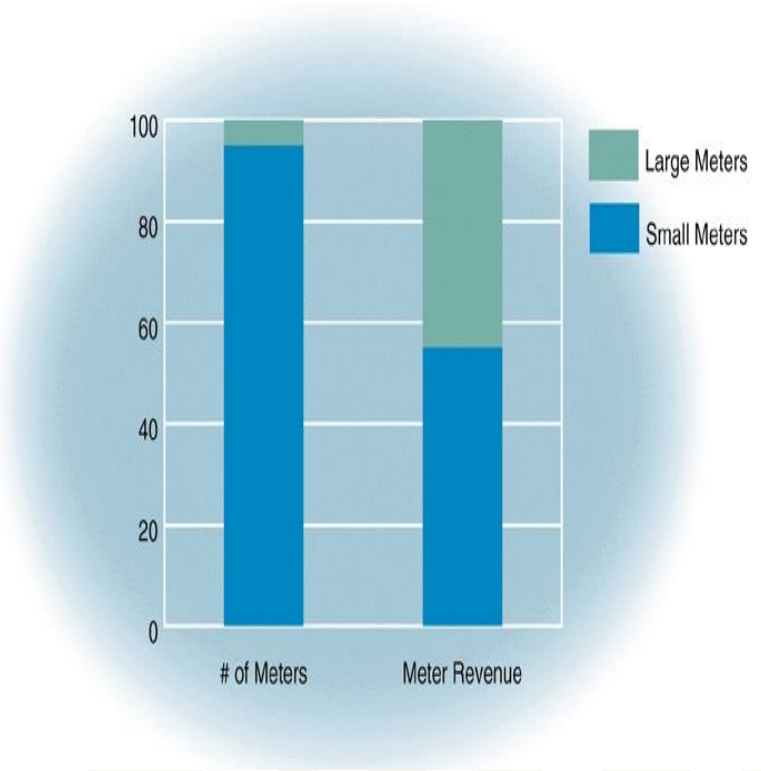


"Biggest Bang for the Buck"

Focus on the Commercial and Industrial Meters

Often, less than 5% of a utility's meters generate more than 40% of the revenue

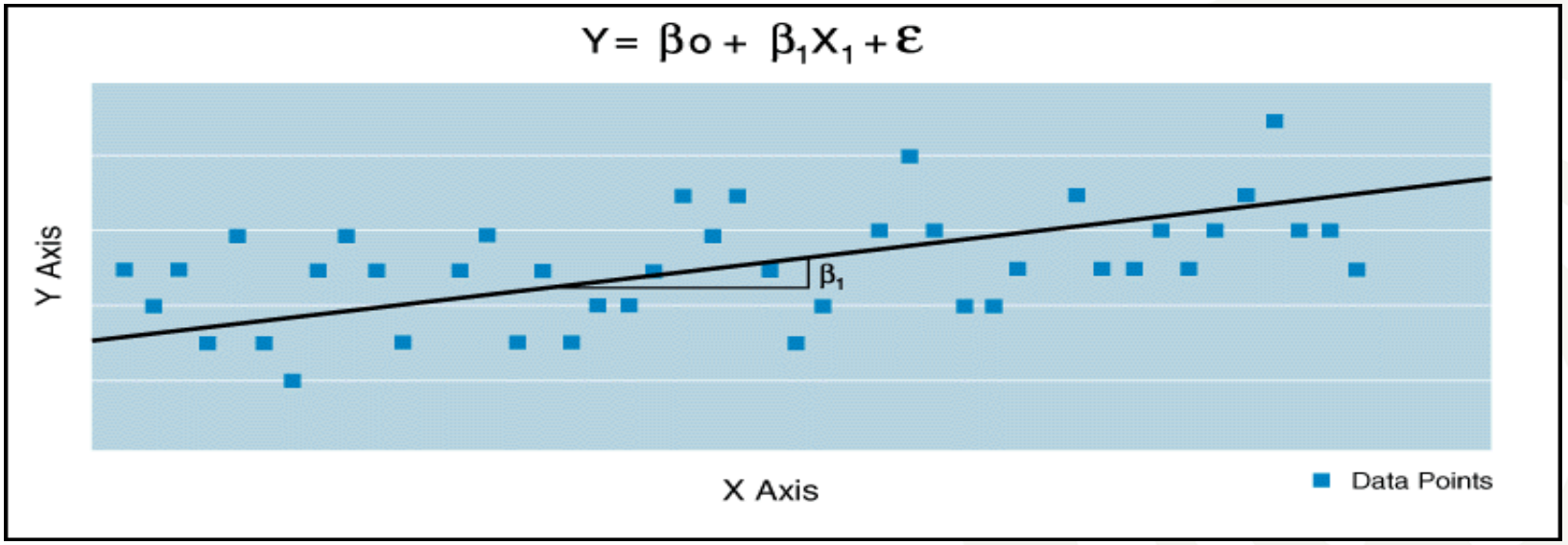
	C&I Accounts	C&I % Sales
Hartford, CT	6%	54%
Springfield, MA	8%	57%



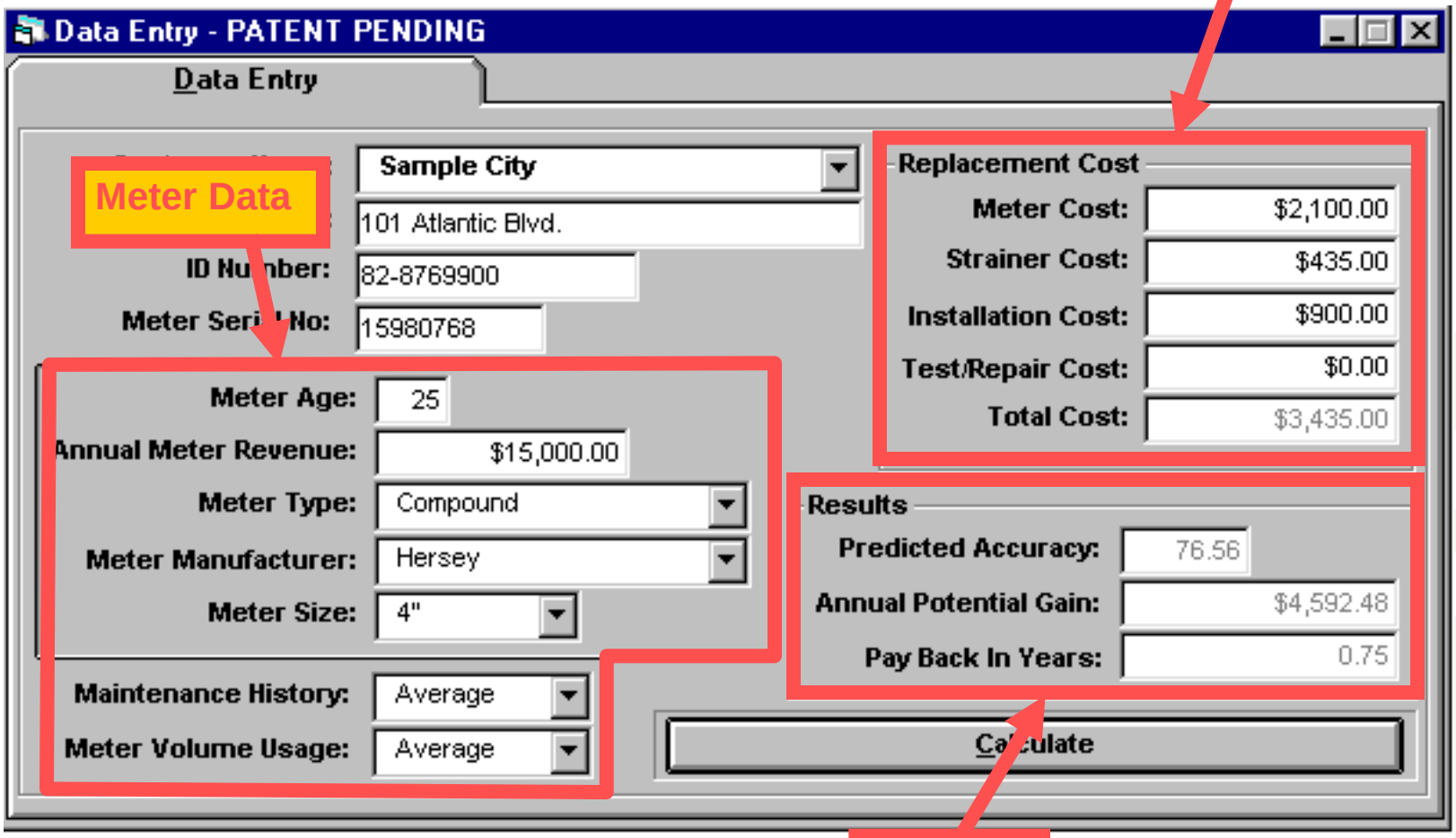
Innovative Way to Maximize Cash-flow

SEER™ Software

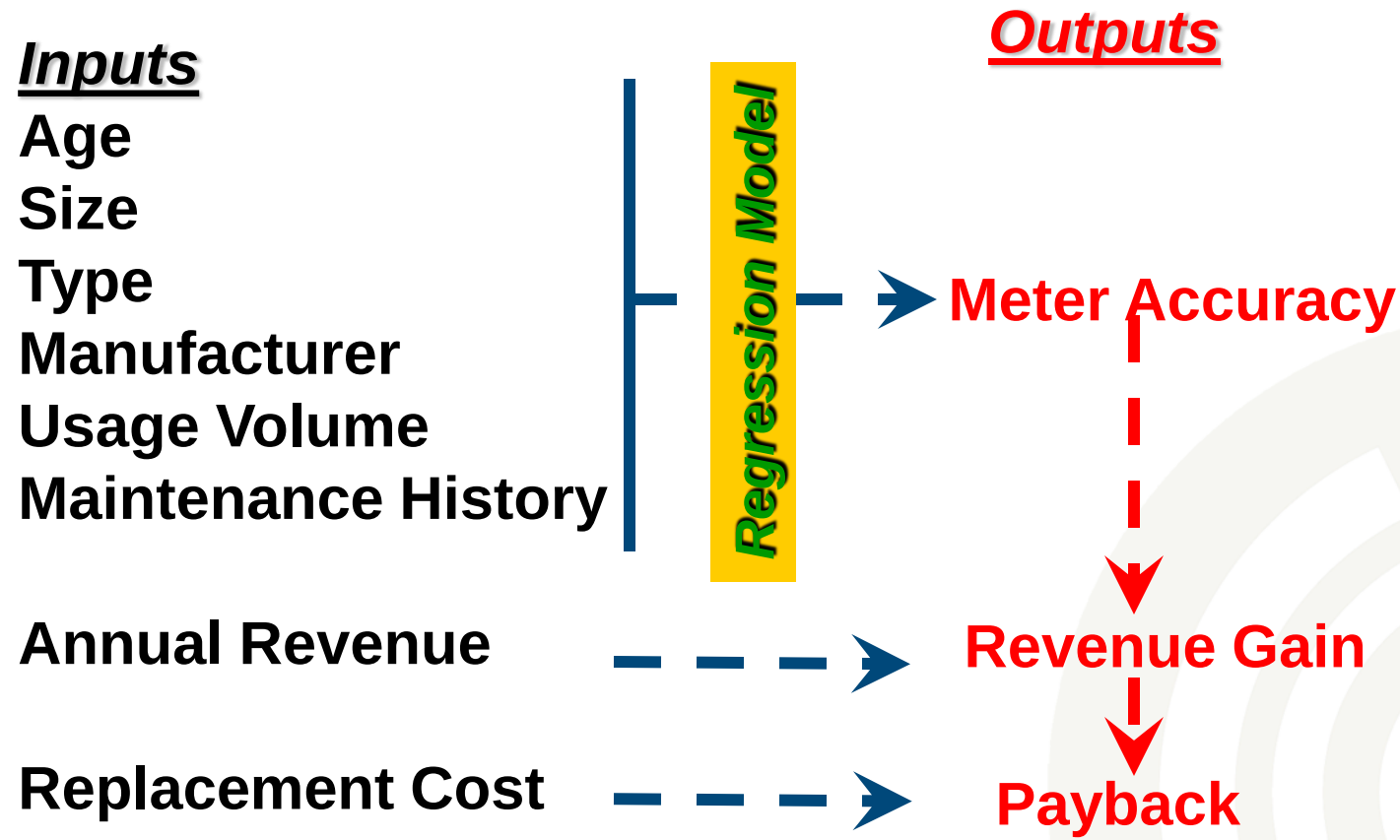
- **Based on over 10,000 large meter tests**
- **Multiple linear regression**
- **Developed and patented by Neptune**



SEER™ Inputs


Replacement Costs
Meter Data
Data Entry - PATENT PENDING
Data Entry
Sample City
101 Atlantic Blvd.
ID Number:
82-8769900
Meter Serial No:
15980768
Meter Age:
25
Annual Meter Revenue:
$15,000.00
Meter Type:
Compound
Meter Manufacturer:
Hersey
Meter Size:
4"
Maintenance History:
Average
Meter Volume Usage:
Average
Replacement Cost
Meter Cost:
$2,100.00
Strainer Cost:
$435.00
Installation Cost:
$900.00
Test/Repair Cost:
$0.00
Total Cost:
$3,435.00
Results
Predicted Accuracy:
76.56
Annual Potential Gain:
$4,592.48
Pay Back In Years:
0.75
Calculate
Results

SEER™ Logic


Outputs
Inputs
Age
Size
Type
Manufacturer
Usage Volume
Maintenance History
Regression Model
Meter Accuracy
Annual Revenue
Revenue Gain
Replacement Cost
Payback

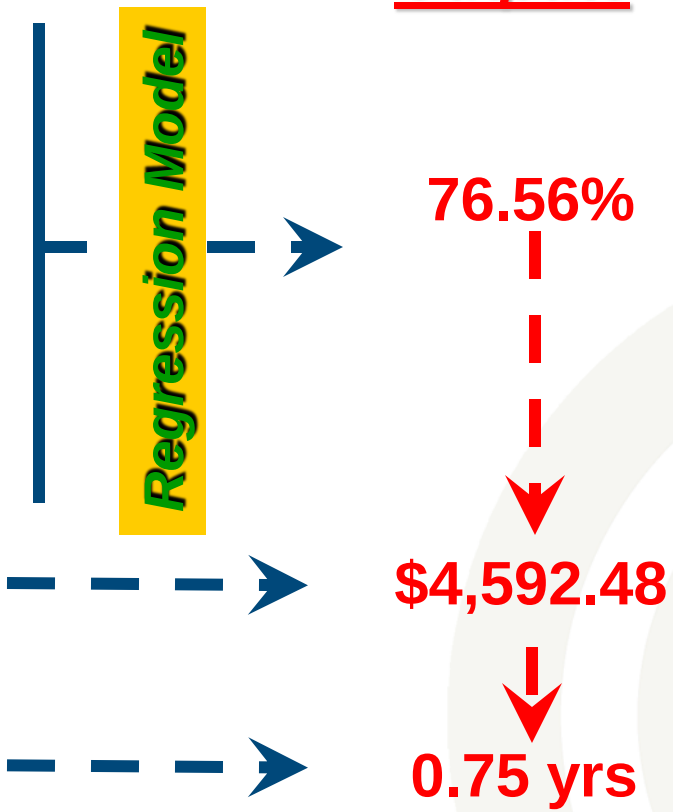
SEER™ Logic

Inputs

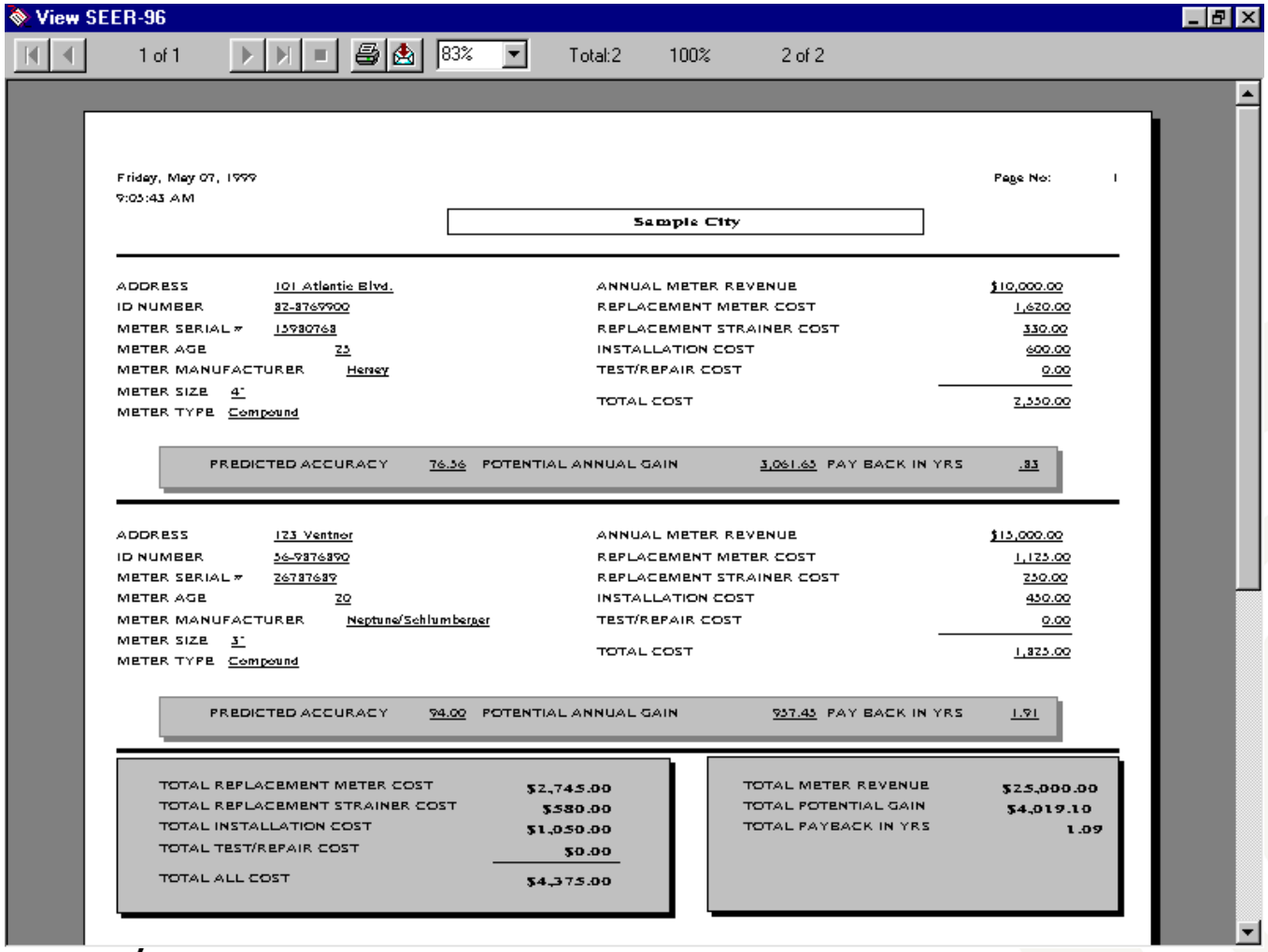
25 yrs
4”
Compound
Hersey
Average
Average

$15,000.00 / yr

$3,435.00



SEER Report


View SEER-96

1 of 1 | 83% | Total:2 | 100% | 2 of 2

Friday, May 07, 1999
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Page No: 1

Sample City

ADDRESS	101 Atlantic Blvd.	ANNUAL METER REVENUE	$10,000.00
ID NUMBER	82-8769900	REPLACEMENT METER COST	1,620.00
METER SERIAL #	15980768	REPLACEMENT STRAINER COST	330.00
METER AGE	25	INSTALLATION COST	600.00
METER MANUFACTURER	Hersey	TEST/REPAIR COST	0.00
METER SIZE	4"	TOTAL COST	2,550.00
METER TYPE	Compound		

PREDICTED ACCURACY 76.36 POTENTIAL ANNUAL GAIN 3,061.63 PAY BACK IN YRS .83

ADDRESS	123 Ventnor	ANNUAL METER REVENUE	$15,000.00
ID NUMBER	56-9876890	REPLACEMENT METER COST	1,125.00
METER SERIAL #	26787689	REPLACEMENT STRAINER COST	250.00
METER AGE	20	INSTALLATION COST	450.00
METER MANUFACTURER	Neptune/Schlumberger	TEST/REPAIR COST	0.00
METER SIZE	3"	TOTAL COST	1,825.00
METER TYPE	Compound		

PREDICTED ACCURACY 94.00 POTENTIAL ANNUAL GAIN 957.43 PAY BACK IN YRS 1.91

TOTAL REPLACEMENT METER COST	$2,745.00
TOTAL REPLACEMENT STRAINER COST	$580.00
TOTAL INSTALLATION COST	$1,050.00
TOTAL TEST/REPAIR COST	$0.00
TOTAL ALL COST	$4,375.00

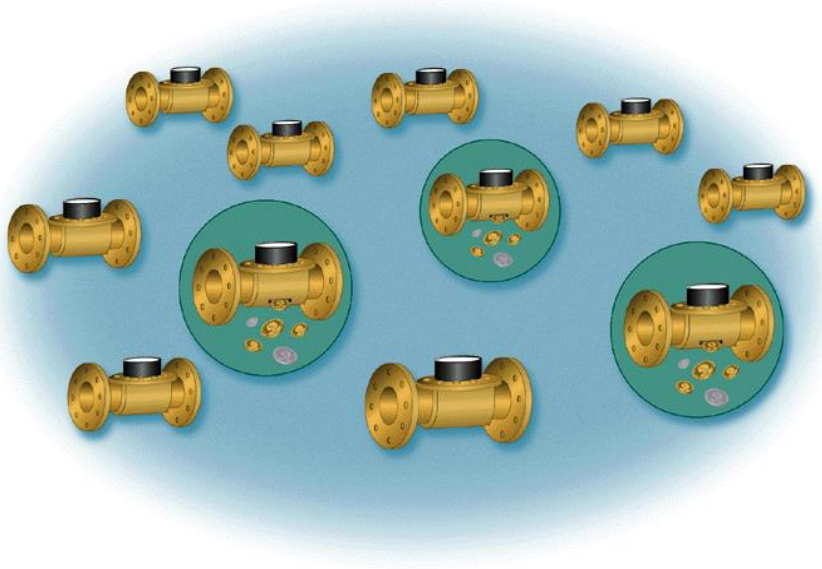
TOTAL METER REVENUE	$25,000.00
TOTAL POTENTIAL GAIN	$4,019.10
TOTAL PAYBACK IN YRS	1.09

SEER™ Pinpoints Revenue Loss

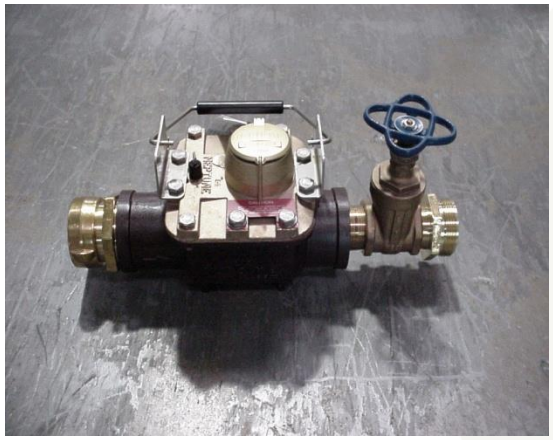
SEER™ Software
Identifies which meters need attention

Establishes priorities based on revenue gain and payback

Allows utilities to implement targeted revenue enhancement programs



Large Meter Testing



Factors to Consider:

- **AWWA recommends on-site testing of large meters on a regular basis**
- **Cost to remove and transport**
- **Flow conditions are different**
- **Liability if meter is contested**
- **Benefit to cost ratio is easily determined**

Meter Size (inches	Years between Tests
5/8	10
¾	8
1	6
1 ½	4
2	4
3	3
4	2
6 +	1

Testing Methods

- Accuracy is determined using a point of reference:
- Common points of reference:
    - Volumetric
        - calibrated tank
    - Gravimetric
        - weight scale
    - Master Meter(s)
        - Most Common for large meters
        - known good meter(s)

Testing Methods

- **Meter Testers**
  - Master Meter (volume to volume)
    - Typical meter tester sizes 3” and 4”

- **Things to Remember**
  - Meter testers cannot test the full range of a meter
  - Provides a snap shot only
  - Start at low flows, then medium, and high flow rates
  - If a test fails, repeat it to verify result.
  - Ensure and verify meter can be isolated
  - Cavitation (maintain 20-30 psi at tester)
  - Meter Tester is not 100% accurate at all flow rates.
  - Calibration certificate

Testing Methods

- **Meter Characteristics - PD**
  - PD meters typically register 100% +/-1.5% or they fail
  - Exception is if the PD meter average flow rate exceeds
  - 50% of its rated flow.
  - Problem: Leak – seal rings (all), valve (compound and
  - FS compound)
  - Premature wear

- **Meter Characteristics – Turbine**
  - Turbines wear on low flow – noticeable through
  - crossover
  - Turbines accuracy improve with increase in flow rate

Testing - Error and Uncertainty

- Any accuracy test is subject to error.
- The goal is to minimize the error and estimate its value.
  - Error: the difference between the true value and the measured value.
  - Uncertainty is an estimate of the error value.
    - Eg: Accuracy = 100.5% +/- 0.25% (95% confidence)
- Sources of Error on test:
  - **Reading resolution of meter**
  - **Reading resolution of tank/test unit**
  - **Human error**
  - **Poor flow profile**

$$TOTAL\ \ ERROR = \sqrt{E_1^2 + E_2^2 + E_3^2 + E_4^2 + \ldots}$$

Portable Field Testing Equipment

- Conduct Field testing with Test meter in location where it is being used
- Accuracy Testing - Site meter with a known test meter
- Water runs through the site meter and then through the test meter

Meter Site Survey

- Document Site Survey information along with Meter Test data
- Establish a meter history book to provide more accurate information on most valuable meters
- Analysis if the existing meter Flow characteristics matches to Commercial Business User characteristics

Field Service Division
Site Survey
City of Belpre

Neptune Equipment

Survey Completed by : Ray Schwarz Date: 5/3/06 Photo #: 1

Name: Kraton Industries

Address: 2419 Rt. 618

Meter Size : 4" Meter Type: Neptune Compound

Age: 2000 (5) Serial #:

Meter Length: 20" Strainer: None

Pin or Inside Set: Vault Usable length of pipe: 18-25"

Inlet Valves:Yes Outlet Valves: Yes

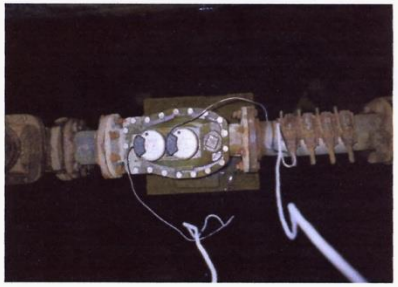
Backflow Prevention: Yes By-Pass: Yes

Plumbing Material: Cast Iron spacers or black pipe

Conditions: Meter located along side the road, large area to work, Vault lid has 18" cast iron lid with a 3'x5' lid that can be removed. Used a repair clamp to replace the previoud meter. Spools were not used when replacing previous meters.

Other Comments: Water usage has dropped since the Business has been using non-potable water from nearby stream. Cooling system no longer using City water.

Recommend an UME Replacement



Techs needed

Hours to compete

Maintenance/Testing

- Testing should be based more on meters consumption history
- Perform at least 3 flows per meter. Start at the low flow
- A minimum of one sweep hand
- A poor test result should be repeatable
- In field calibration can be performed on some meters +/- 3% to 5%
- Spare Measuring Elements will allow for minimal customer disruption.
- Verify isolation valve closure
- Use calibration certificate of tester
- Clean Strainer

Thank you